

# REPORT DOCUMENTATION PAGE

Form Approved  
OMB No. 0704-0188

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE 3/11/97	3. REPORT TYPE AND DATES COVERED Annual Technical 1/1/96 - 12/31/96	
4. TITLE AND SUBTITLE Quantum Chaos in Rydberg Atoms			5. FUNDING NUMBERS N00014-96-1-0484	
6. AUTHOR(S) Prof. Daniel Kleppner				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Research Laboratory of Electronics Massachusetts Institute of Technology 77 Massachusetts Avenue Cambridge, MA 02139			8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) Office of Naval Research Ballston Centre Tower One 800 North Quincy Street Arlington, VA 22217-5660			10. SPONSORING/MONITORING AGENCY REPORT NUMBER 96PR0271300	
11. SUPPLEMENTARY NOTES The view, opinions and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.				
12a. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words)  Work by Prof. Kleppner and his collaborators is summarized here				
14. SUBJECT TERMS			15. NUMBER OF PAGES	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT UL	

19970317 005

GRANT NO N00014-96-1-0484  
QUANTUM CHAOS IN RYDBERG ATOMS  
January 1, 1996- December 31, 1996  
Daniel Kleppner, Principal Investigator

ANNUAL TECHNICAL REPORT

During this year we have demonstrated a new experimental technique for studying the interface of classical and quantum dynamics, based on our previous work in recurrence spectroscopy. The subject is a lithium atom in an applied electric field, and the starting point is the recurrence spectrum in various energy regimes. We selected a particularly simple regime where a single classical orbit, and its repetitions, is manifest in the recurrence spectrum. In our new method, the system is perturbed with an oscillating electric field whose frequency is varied in the vicinity of the frequency of the primary classical orbit. We have been able to do this under conditions of scaled energy spectroscopy, in which the static and oscillating field amplitudes, the frequency, and the laser energy are all varied simultaneously so as to maintain conditions of constant classical dynamics. We have observed the creation and destruction of orbits by our field, and the systematic perturbation of the action of various orbits. In collaboration with Prof. John Delos of the College of William and Mary, a theoretical framework has been constructed which appears capable of providing a good quantitative description of the phenomena.

This work has not yet been published, but a submission to Physical Review Letters is under preparation, to be followed by other papers.

# ATTACHMENT NUMBER 1

## REPORTS AND REPORT DISTRIBUTION

### REPORT TYPES

- (a) Performance (Technical) Report(s) (Include letter report(s)) Frequency: Annual
- (b) Final Technical Report, issued at completion of Grant.  
NOTE: Technical Reports must have a SF-298 accompanying them.
- (c) Final Financial Status Report (SF 269)
- (d) Final Patent Report (DD 882)

REPORTS DISTRIBUTION		
ADDRESSEES	REPORT TYPES	NUMBER OF COPIES
Office of Naval Research Program Officer Peter J. Reynolds ONR 331 Ballston Centre Tower One 800 North Quincy Street Arlington, VA 22217-5660	(a) & (b) w/(SF-298's)	3
Administrative Grants Officer OFFICE OF NAVAL RESEARCH REGIONAL OFFICE BOSTON 495 SUMMER STREET ROOM 103 BOSTON, MA 02210-2109	(c), (d) & SF-298's only for (a) & (b)	1
Director, Naval Research Laboratory Attn: Code 2627 4555 Overlook Drive Washington, DC 20375-5326	(a) & (b) w/(SF-298's)	1
Defense Technical Information Center 8725 John J. Kingman Road STE 0944 Ft. Belvoir, VA 22060-6218	(a) & (b) w/(SF-298's)	2
Office of Naval Research Attn: ONR 00CC1 Ballston Centre Tower One 800 North Quincy Street Arlington, VA 22217-5660	(d)	1

If the Program Officer directs, the Grantee shall make additional distribution of technical reports in accordance with a supplemental distribution list provided by the Program Officer. The supplemental distribution list shall not exceed 250 addresses.